2018 Fall Meeting

MATERIALS FOR ENERGY

B

Battery and energy storage devices

For sustainable economic growth and environment protection, energy generated from renewable sources has to be converted and stored by highly efficient and ecofriendly ways. Rechargeable batteries and supercapacitors are in the center of interest all over the world for the development of electrochemical energy storage system from the macroscale to the microscale.

Scope:

Electrochemical energy storage is a rapidly advancing field building on a continuous stream of innovative ideas. As renewable energy sources become increasingly prevalent the need for high energy-density, high- power storage devices with long cycle lives is greater than ever. The development of suitable materials for these devices begins with a complete understanding of the complex processes that govern energy storage and conversion spanning many orders of magnitude in length and time scales. The focus of this meeting is to bring together all aspects of batteries and electrochemical storage devices across multiple scales, from modelling and nanoscale characterization to full-scale battery construction and testing regimes. An interdisciplinary selection of speakers will cover this broad range of topics to develop an overview of the current research and challenges in the battery field. The intention is to bring together the international community working on the subjects and to enable effective interactions between research and engineering communities. Although a Europe-bound event, participation is invited from all continents. It provides an excellent opportunity for scientists, engineers and manufactures to present recent technical progress and products, to establish new contacts in the appreciated networking events and to exchange scientific and technical information. The symposium is structured in nine different sections covering diagnostic techniques and systems design/components.

Hot topics to be covered by the symposium:

- Lithium ion cells
- Non lithium technologies
- Flow-batteries
- Supercapacitors
- Battery systems
- Automotive and mobile applications
- Stationary battery system
- Integrated systems
- LCA electrochemical storage

START AT	SUBJECT	View All	NUM.

B1 : KUPECKI JAKUB

09:00 Cross-linked polymer electrolytes towards safe and durable lithium metal batteries **B.1.1**

Authors : Jijeesh Ravi Nair, Martin Winter
Affiliations : Helmholtz Institute Münster, IEK-12, Forschungszentrum Jülich GmbH, Corrensstr. 46, 48149 Münster, Germany

Resume : Solid polymer electrolytes (SPEs) are introduced as a safe alternative to existing and widely used organic carbonate-based liquid electrolytes. In the field of lithium-ion battery (LiB), the liquid-state to solid-state transformation is expected to enhance safety, fast and reliable fabrication, and thermal stability. However, several constraints have restricted their entry into the production line such as low ionic conductivity, low cation transport properties and stringent processing conditions (use of organic solvents). Thus, the researchers have proposed several approaches including the in situ polymerization technique, which can be performed in a solvent-free environment. The thermally induced crosslinking process is a rapid and a hassle-free technique. Ionic conductivity can be fine-tuned by reducing the crystallinity, which in turn increases the amorphous character of the polymer matrix. Indeed, lithium ion conduction is directly linked to polymer chain mobility and increased amorphous nature can facilitate the ambient temperature ionic conductivity. Thus, SPE is produced using a thermally induced polymerisation process, which ensures the production of a thin, transparent and flexible membrane. The resulted membrane exhibits oxidation stability above 4.5V vs. Li/Li+, thermal stability above 150°C and cycles against $LiFePO_4$ based cathodes in lithium metal cells for several hundreds of cycles. Thus, crosslinking is a fast and reliable option for the development of industrially up scalable polymer electrolytes for lithium metal batteries.

START AT	SUBJECT View All	NUM.
09:30	The Nature Inspired Structure of Zinc Oxide Nanorods over Nanofibers for Novel Flexible Supercapacitors	**B.1.2**
09:45	Superionic diffusion through frustrated energy landscape	**B.1.3**
10:00	Spinel-type oxides supported on carbon nanofibers as bifunctional oxygen electrodes for alkaline metal-air batteries	**B.1.4**
10:15	ELECTROCHEMICAL CHARACTERISATION OF LITHIUM ALKYLTRIALKOXYBORATES ELECTROLYTES	**B.1.5**

B2 : WEIL MARCEL

11:00	Novel Cathode and Anode Materials for Sodium-Ion Batteries	**B.2.1**
11:30	Polyaniline/carbon nanocomposites as supercapacitor electrode materials	**B.2.2**
11:45	Solid-like polymer electrolytes for safe, low-cost and durable sodium-ion batteries working at ambient temperature	**B.2.3**
12:00	Investigation of bi-porous electrodes for lithium oxygen batteries: from modeling to experimental electrodes development	**B.2.4**
12:15	Design, realization and characterization of a simple and cost-effective Iron-air battery	**B.2.5**

START AT	SUBJECT	View All	NUM.
	B3 : JIJEESH RAVI NAIR		
14:00	Life cycle sustainability analysis of present and future battery systems		**B.3.1**
14:30	Conversion/alloying anodes for Li-ion batteries: Evaluation of the energy efficiency and volume expansion during cycling		**B.3.2**
14:45	The effect of aliovalent doping on the Li+ storage mechanism in transition metal doped ZnO for lithium-ion anodes		**B.3.3**
15:00	Dynamic Observation of Reversible Lithium Storage Mechanism in Hybrid Supercapacitor Devices		**B.3.4**
15:15	Electrochemical Lead-acid Battery Recycling using Deep Eutectic Solvents		**B.3.5**
	B4 : WEI-REN LIU		
16:00	Energy storage systems based on solid oxide electrolysis (SOE) - key aspects of modeling and simulation		**B.4.1**
16:30	Spray pyrolysis of conductor and binder free porous FeS2 films for high performance lithium ion batteries		**B.4.2**
16:45	Microstructure characterization and electrochemical properties of CaNI5-based alloys prepared by mechanical milling		**B.4.3**

START AT	SUBJECT	View All	NUM.
17:00	A Novel Fabrication and Characterization of 3D-Printed Battery		**B.4.4**
17:15	Importantce of Defects on Electrical/Electrochemical Properties of Electrode Materials for Li Batteries		**B.4.5**

POSTER SESSION 1 : VINCENZO BAGLIO

17:30	Improvement of electrical properties of Co-free and Mn-rich LixNi0.35Mn0.65O2 cathode with graphene prepared by sol-gel method		**B.P1.1**
17:30	Highly Flexible and Transparent Supercapacitor for Wearable Energy Storage		**B.P1.2**
17:30	Single-Site Active Iron-Based Bifunctional Oxygen Catalyst for a Compressible and Rechargeable Zinc-Air Battery		**B.P1.4**
17:30	Synthesis of the levelers for high-density interconnect and their structure-property relationships on Cu electrodeposition		**B.P1.5**
17:30	Light-weight 3D Co-N-doping hollow carbon spheres as efficient electrocatalyst for rechargeable zinc-air battery		**B.P1.6**
17:30	Optimal allocation of electric vehicle charging stations in a highway network: the Italian case study		**B.P1.7**
17:30	Experimental test drive of a fuel cell hybrid electric minibus		**B.P1.8**

START AT	SUBJECT View All	NUM.
17:30	Evaluation of hydrogen production cost in three different real case studies	**B.P1.9**
17:30	Monitoring Electrolyte Decomposition in Lithium Ion Batteries by Operando GCMS Gas Analysis	**B.P1.10**
17:30	Enhanced electrochemical performance of composite polymer electrolyte reinforced with LLZNO for all-solid-state lithium battery	**B.P1.11**
17:30	Co-addition of garnet LLZTO particles and EC in PEO/LiClO4 solid electrolytes for optimizing performances of lithium batteries	**B.P1.12**
17:30	High Capacity All-Solid-State Sodium Battery Using TiO2 NW Reinforced Polymer Composite Electrolyte with NaSICON-CNT Cathode	**B.P1.13**
17:30	Chemically Impregnated NiO Catalyst for Closed Li-O2 Cell Using Binary Molten Electrolyte	**B.P1.14**
17:30	Development of corrugated LATP electrolyte sheet for three dimensional structured all solid-state battery	**B.P1.15**
17:30	Synthesis and Electrochemical Characteristics of Carbon-coated SiO2/ZnO Composite by Pyrolysis of PVC	**B.P1.16**
17:30	Synergistic redox systems and nanostructured materials for use in high temperature batteries (sodium-nickel chloride)	**B.P1.17**

START AT	SUBJECT View All	NUM.
17:30	Structure and Dynamics of Li-rich Li1+xAlxTi2-x(PO4)3 (LATP), where 0.3	**B.P1.18**
17:30	Polyelectrolytes based on Nafion for Lithium Rechargeable Batteries	**B.P1.19**
17:30	New sodium ion battery positive electrodes and role of the interface on the cell electrochemical performance	**B.P1.20**
17:30	Recycling of protective layer for Ni rich layered oxide material for Li ion batteries	**B.P1.21**
17:30	Anion Exchange Membranes based Urushi/MAPTAC in Non - aqueous Redox Flow Battery	**B.P1.22**
17:30	High Ion Conductive Composite membranes using ladder structured Polysilsesquioxane for Non-Aqueous Vanadium Redox Flow Battery	**B.P1.23**
17:30	Factors Affecting Capacity Fading of Li-Rich Layered Oxide Cathode	**B.P1.24**
17:30	Electrochemical characterization of polymer electrolyte based on PVA and pyrrolidinium ionic liquid	**B.P1.25**
17:30	Effect of Electrode/ Electrolyte Reaction on Electrical/Electrochemical Properties of Li1.3Al0.3Ti1.7(PO4)3 Solid Electrolytes	**B.P1.26**

START AT	SUBJECT	View All	NUM.
17:30	Electrochemical Behaviour of Composite Material Combining Cultivated Diatoms Algae Containing Biosilica and Organic Precursor of		**B.P1.27**
17:30	Electrochemical Behaviour of Diatomic Earth As a Precursor for Anode Material Type Si@SiOx		**B.P1.28**
17:30	Performance improvement of ZEBRA Batteries By using a simple and functional planar architecture		**B.P1.29**
17:30	Second life employment of a traction battery for load match optimisation of a residential building: Life cycle and operation applications		**B.P1.30**

START AT	SUBJECT	View All	NUM.
	B5 : ROBERT KOSTECKI		
09:00	Towards solid-state batteries operating at room temperature: (composite) polymer electrolytes in a crosslinked PEO matrix		**B.5.1**
09:30	Results of one-year operation from a 5 MW and 5 MWh battery storage system with different battery technologies		**B.5.2**
09:45	All-in-One Stretchable Fiber-Shaped Supercapacitors		**B.5.3**
10:00	Comparison of Constant Current and Constant Voltage Operation MCDI upon different choices of materials		**B.5.4**

START AT	SUBJECT	View All	NUM.
10:15	Development of Novel Nanostructured composites materials for Li-O2 battery		**B.5.5**

B6 : CHIARA FERRARA

11:00	Unveiling the first nucleation and growth steps of inorganic Solid Electrolyte Interphase		**B.6.1**
11:30	High-Level Supercapacitive Performance of Chemically Reduced Graphene Oxide		**B.6.2**
11:45	AN ALTERNATIVE SOLUTION OF INTERNAL SHORT AND SAFETY PROBLEMS IN LITHIUM ION BATTERY		**B.6.3**
12:00	Synthesis of small-size transition metal oxides mixtures (TMOMs) based on NiO nanocubes and MoO3 promoted by the incorporation o		**B.6.4**
12:15	Polymer Composite Membranes as a Solution to Every LiS Battery Issue		**B.6.5**

B7 : CLAUDIO GERBALDI

14:00	On the Origins of Interfacial Instability of Intermetallic Li-ion Anodes		**B.7.1**
14:30	Novel Non-Aqueous Organic Electrolytes with High Ionic Conductivity for Rechargeable Li-ion Battery		**B.7.2**
14:45	New insights on Solid Oxide Fe-Air Battery Cell		**B.7.3**

START AT	SUBJECT	View All	NUM.
15:00	Single-Site Active Iron-Based Bifunctional Oxygen Catalyst for a Compressible and Rechargeable Zinc-Air Battery		**B.7.4**
15:15	Exploring InSb alloy as negative electrode for Mg-ion batteries		**B.7.5**

B8 : EL-MELLOUHI FADWA

16:00	Black phosphorus as anode for rechargeable Na ion batteries: the role of preparation		**B.8.1**
16:30	Advanced Structural Characterization of Energy Storage Materials		**B.8.2**
16:45	Evaluation of electrospun nickel manganite-carbon nanofibers (NiMn2O4/CNF) for vanadium redox flow battery application.		**B.8.3**
17:00	H2 production by NiFe2O4 3D hollow spheres using a microfluidic electrolysis system		**B.8.4**
17:15	DEVELOPMENT OF POLYMERIC MATERIALS FOR LITHIUM BATTERIES		**B.8.5**

START AT	SUBJECT	View All	NUM.

B9 : VINCENZO BAGLIO

14:00	High Capacity Cathode Materials Invoking Oxygen Redox Chemistry		**B.9.1**

START AT	SUBJECT	View All	NUM.
14:30	Reducing the environmental impact of LIBs by cautious management through integration of degradation stress factors into LCA		**B.9.2**
14:45	Characterization and modeling of lithium-polymer commertial batteries		**B.9.3**
15:00	A mechanical fatigue approach to model parameters' ageing in lithium-ion batteries.		**B.9.4**
15:15	Cathode processing studies towards improved sodium-ion battery performance		**B.9.5**

B10 : ALESSANDRA DI BLASI

16:00	Fuel Cells Hybrid Systems For Resilient Microgrids		**B.10.1**
16:15	Highly conductive solid polymer electrolytes for all solid-state lithium metal batteries		**B.10.2**
16:30	Design of strain tolerant composite cathodes for all-solid-state batteries		**B.10.3**
16:45	Relation between ex-situ and TEM in-situ cyclic voltammetry in the study of the Pt catalyst degradation in PEMFCs		**B.10.4**
17:00	Core@shell silicon-carbon nanoparticles with a tunable shell thickness: performances as battery anodes		**B.10.5**

START AT	SUBJECT	View All	NUM.
17:15	In-Situ Investigation of Lithium-Ion Batteries by Combined Mechanical FRF and Dilatometer Measurements		**B.10.6**
17:30	Reversible Control of Magnetism in FeF3·3H2O		**B.10.7**

START AT	SUBJECT	View All	NUM.

B11 : SERGI FRANCESCO

09:00	Li-air battery		**B.11.1**
09:15	Development of new doped lithium titanium sulfides		**B.11.2**
09:30	Novel Methyl Imidazolium Based Fluorine Containing Ionic Salts as Potential Electrolytes for Lithium Ion Battery		**B.11.3**
09:45	Recycling of protective layer for Ni rich layered oxide material for Li ion batteries		**B.11.4**
10:00	Towards High capacity, Low cost LiMBO3 (M = Mn, Co) cathodes for Lithium–ion batteries		**B.11.5**
10:15	An XPS study of the passivation layer on Lithium Rich Cathode Material		**B.11.6**

B12 : JANET LEDESMA GARCIA

START AT	SUBJECT	View All	NUM.
11:00	Evaluation of a Li-Titanate battery module in frequency regulation ancillary service		**B.12.1**
11:15	Silicon Nanocrystal/Graphene Aerogel Hybrids as Anode Materials for Lithium Ion Batteries		**B.12.2**
11:30	Mass-Producible Self-Induced Sulfur/Polymer/Graphene Structure for Cathode of Lithium Metal Batteries		**B.12.3**
11:45	Two-dimensional Metal Chalcogenides for Li-ion Battery Applications		**B.12.4**
12:00	Understanding Charge Storage Mechanism of Mixed Metal Sulfides in Alkaline Media: NiCoMnS2 Nano-needles Case Study		**B.12.5**
12:15	Synthesis and characterization of Co3O4 flakes-like and NiCo2O4 spinel nanomaterials for oxygen reduction reaction in alkaline m		**B.12.6**

B13 : LOUIS GERARDO ARRIAGA HURTADO

14:00	Electrospun nanofibrous as efficient separator for Zinc-Air Batteries		**B.13.1**
14:15	Towards thorough characterization of lithium/sulfur batteries by coupling tomography techniques		**B.13.2**

START AT	SUBJECT	View All	NUM.
14:30	Surface Modified Metal Hydrides as Negative Electrodes in NiMH Batteries		**B.13.3**

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Affiliations : Center for Energy Materials and Storage Devices, Middle East Technical University, Çankaya 06800, Ankara Dept. of Metallurgical and Materials Engineering, Middle East Technical University, Çankaya 06800, Ankara

Resume : There is a renewed interest in NiMH batteries with improved energy densities that could approach those of Li-ion batteries. Efforts to improve the energy density concentrates on alternative anode as well as cathode materials. For anode, AB2 and Mg based alloys are candidates with potentials that go beyond the capacity achieved with rare-earth based AB5 compounds. In a recent study [1] we have shown an AB2 alloy which is sluggish in its activation could readily be activated when it was surface modified with hot-alkaline treatment. The treatment resulting in fine porous surface rich in Ni not only activates the alloy but it also increases the discharge capacity by a significant amount. This was attributed to positive effect of porous surface where hydrogen evolution was made difficult by the associated stabilizing effect. For Mg based alloys, we have investigated A2B7 alloy where the amount of Mg is quite low and an amorphous Mg50Ni50 alloy. Here rather than modifying the powders, the electrode itself was modified by nafion coating. The electrodes were tested both in bare and coated form with a notable difference in discharge capacity. Nafion coating increased maximum attainable discharge capacity in both alloys up to 150%. Electrochemical impedance spectroscopy measurements showed that the charge transfer resistance increases with coating. The role of nafion coating in developing Mg based negative electrode materials is discussed. [1] Tan S., Shen Y., Sahin E. O., Noréus D., Ozturk T., "Activation behavior of an AB2 type metal hydride alloy for NiMH batteries" International Journal of Hydrogen Energy 41 (23), 9948-9953,2016

14:45	New sodium ion battery positive electrodes and role of the interface on the cell electrochemical performance		**B.13.4**

START AT	SUBJECT	View All	NUM.
15:00	High Performance Titanium Antimonide TiSb2 Alloy for Na-ion Batteries and Capacitors		**B.13.5**
15:15	Solid Oxide Electrolysis Cell degradation during mid-term operation - experimental and numerical analysis		**B.13.6**

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